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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/560,448
Filing Date: December 13, 2005
Appellant(s): BOURRET ET AL.

Raymond Y. Mah
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed April 12, 2011 appealing from the Office action mailed October 15, 2010.

(1) Real Party in Interest

The examiner has no comment on the statement, or lack of statement, identifying by name the real party in interest in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The following is a list of claims that are rejected and pending in the application:

Claims 1-17 and 20-53 are pending and have been rejected. Claims 18-19 have been canceled.

(4) Status of Amendments After Final

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

(5) Summary of Claimed Subject Matter

The examiner has no comment on the summary of claimed subject matter contained in the brief.

(6) Grounds of Rejection to be Reviewed on Appeal

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the

subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

(7) Claims Appendix

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant's brief.

(8) Evidence Relied Upon

6,483,538	HU	11-2002
5,446,492	WOLF et al.	8-1995
6,295,083	KUHN	9-2001

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections – 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-6, 17, 20-25, 36-40 and 51-53 are rejected under 35 U.S.C. 102(e) as being anticipate by Hu (US Patent No. 6,483,538 B2).

In considering claim 1, Hu discloses all the claimed subject matter, note 1) the claimed matching, by execution of a computer system, sub-field/frame elements of a test video field/frame with corresponding sub-field/frame elements of at least one reference video field/frame, and thereby generating for the test video field/frame a matched reference field/frame comprising the sub-field/frame elements of the at least one reference video field/frame which match to the sub-field/frame elements of the test video field/frame is met by the video capture 16 which captures corresponding images or frames from the test image and the reference image (Figs 1-2, col. 2, lines 31-59), 2) the claimed positioning, by execution of the computer system, in the matched reference video fields/frame at least one of the matching sub-field/frame elements to compensate for misalignment between at least one of the sub-field/frame elements of the test video field/frame and the at least one matching sub-field/frame elements is met by the high precision sub-pixel spatial alignment detect module 18 and the position shift module 20 (Figs 1-3, col. 2, line 31 to col. 3, line 55), and 3) the claimed generating, by exe0cution of the computer system, a video quality value in dependence on the matched sub-field/frame elements of the test and matched reference video fields/frames so as to reduce the adverse effects of sub-field/frame misalignments between the reference and test field/frames is met by the Picture Quality Analyzer 22 (Figs 1-2, col. 2, line 31 to col. 3, line 55).

In considering claim 2, the claimed wherein the matching step further comprises, for a sub-field/frame element of the test video field/frame, searching for a matching sub-field/frame element within M1 preceding and/or M2 succeeding reference video

fields/frames to a temporally corresponding reference video field/frame to the test video field/frame is met by the test region of block 28 which is overlaid on both reference and test images (Figs 1-3, col. 2, line 31 to col. 3, line 55).

In considering claim 3, the claimed wherein M1 and M2 are predefined is met by the test region of block 28 which is overlaid on both reference and test images (Figs 1-3, col. 2, line 31 to col. 3, line 55).

In considering claim 4, the claimed wherein the searching further comprises searching within a spatially bounded region of the reference video fields/frames about the corresponding position within the reference fields/frames as the test sub-field/frame element takes within the test video field/frame is met by the test region of block 28 which is overlaid on both reference and test images to a correlation measurement module 32 (Figs 1-3, col. 2, line 31 to col. 3, line 55).

In considering claim 5, the claimed wherein the spatial bound of the search region is predefined is met by the test region of block 28 which is overlaid on both reference and test images to a correlation measurement module 32 (Figs 1-3, col. 2, line 31 to col. 3, line 55).

In considering claim 6, the claimed wherein the matching further comprises, for a sub-field/frame element of the test video field/frame: defining a matching template comprising a portion of the test video field/frame including the sub-field/frame element; and using the defined matching template to search for matching sub-field/frame elements in the at least one reference video field/frame is met by the test region of block

28 which is overlaid on both reference and test images to a correlation measurement module 32 (Figs 1-3, col. 2, line 31 to col. 3, line 55).

Claim 17 is rejected for the same reason as discussed in claim 1 above.

Claims 20-25 are rejected for the same reason as discussed in claims 1-6, respectively.

Claims 36-40 are rejected for the same reason as discussed in claims 2-6, respectively.

In considering claim 51, the claimed wherein said positioning includes positioning a plurality of the matching sub-field/frame elements to compensate for misalignments between a plurality of the sub-field/frame elements of the test video field/frame and the plurality of the matching sub-field/frame elements is met by the high precision sub-pixel spatial alignment detect module 18 and the position shift module 20 (Figs 1-3, col. 2, line 31 to col. 3, line 55).

Claim 52 is rejected for the same reason as discussed in claim 51 above.

Claim 53 is rejected for the same reason as discussed in claim 51 above.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 7-10, 26-29 and 41-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hu (US Patent No. 6,483,538 B2) in view of Wolf et al. (US Patent No. 5,446,492).

In considering claim 7, Hu discloses all the limitations of the instant invention as discussed in claim 1 above, except for providing the claimed wherein the matching further comprises calculating one or more matching statistic values and/or matching vectors; and wherein the generating step generates the video quality parameter in further dependence on the calculated matching statistic values and/or matching vectors. Wolf et al teach that the source and destination spatial statistics processors 22 and 30 compute the standard deviation of the pixel contained within the Region Of Interest (ROI) for which the video quality is to be measured, the ROI may be the entire image, but preferably it is a small subset of the pixels forming the entire image (Fig. 2, col. 6, line 3 to col. 8, line 38). Therefore, it would have been obvious to one ordinary skill in the art at the time of the invention to incorporate the calculating statistic value as taught by Wolf et al into Hu's system in order to provide a method of measuring video quality that agrees closely with the perceptual video quality obtained from large panel of human viewers.

In considering claim 8, the claimed wherein the calculating comprises: constructing one or more histograms relating to the searched area (s) of the reference video field (s)/frame (s); and calculating a matching statistic value for each histogram relating to the proportion of matched elements which contribute to the peak of the histogram is met by the source and destination spatial statistics processors 22 and 30

compute the standard deviation of the pixel contained within the Region Of Interest (ROI) for which the video quality is to be measured, the ROI may be the entire image, but preferably it is a small subset of the pixels forming the entire image (Fig. 2, col. 6, line 3 to col. 8, line 38 of Wolf et al).

In considering claim 9, Hu discloses all the limitations of the instant invention as discussed in claim 1 above, except for providing the claimed wherein the generating further comprises: calculating a plurality of video characteristic values respectively relating to characteristics of the test and/or reference video fields/frames in dependence on the matched sub-field/frame elements of the test and reference video fields/frames; and integrating at least the calculated video characteristic values together to give the video quality value. Wolf et al teach that the source features 7 and the destination features 9 are used by the quality processor 35 to compute a set of quality parameters 13 (p1, p2,…) and quality score parameter 14 (q), …the design process determines the internal operation of the statistics processors 22, 24, 30, 32 and the quality processor 35 (Fig. 2, col. 4, line 8 to col. 5, line 38). Therefore, it would have been obvious to one ordinary skill in the art at the time of the invention to incorporate the calculating plurality of the video characteristic values as taught by Wolf et al into Hu's system in order to provide a method of measuring video quality that agrees closely with the perceptual video quality obtained from large panel of human viewers.

Claim 10 is rejected for the same reason as discussed in claim 7 above.

Claims 26-29 are rejected for the same reason as discussed in claims 7-10, respectively.

Claims 41-44 are rejected for the same reason as discussed in claims 7-10, respectively.

5. Claims 11-16, 30-35 and 45-50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hu (US Patent No. 6,483,538 B2) in view of Wolf et al. (US Patent No. 5,446,492), and further in view of Kuhn (US Patent No. 6,295,083 B1).

In considering claim 11, the combination of Hu and Wolf et al disclose all the limitations of the instant invention as discussed in claims 1 and 9 above, except for providing the claimed wherein the video characteristic values are respectively any two or more of the following values: one or more spatial frequency values; one or more texture values; at least one edge value; at least one luminance signal to noise ratio value; and/or one or more chrominance signal to noise ratio values. Kuhn teaches that as shown in Fig. 2 the cross-correlation from the locating stages provides an integer pixel shift, this integer pixel shift is used to locate the data from image that is centered on a significant feature of the alignment pattern, such as a rising and/or falling edge (Figs. 1C and 1D, col. 3, line 5 to col. 4, line 3). Therefore, it would have been obvious to one ordinary skill in the art at the time of the invention to incorporate the edge values as taught by Kuhn into the combination of Hu and Wolf et al's system in order to high precision image alignment detection for the registration of two images.

In considering claim 12, the claimed wherein the calculation of the edge value comprises, for a test field/frame: counting a number of edges in each sub-field/frame element of the test field/frame; counting a number of edges in each sub-field/frame element of the at least one reference field/frame matched to the sub-field/frame

elements of the test field/frame; and determining an edge value for the test field/frame in dependence on the respective counts is met by the buffer register stores the values of a group of pixels surrounding both the rising and falling edges of the alignment blocks (Figs. 1C and 1D, col. 3, line 5 to col. 4, line 3 of Kuhn).

In considering claim 13, the claimed wherein the determining further comprises: calculating difference values between each pair of respective counts; putting each calculated difference value to the power Q; summing the resulting values to give a sum value; and putting the sum value to the power 1/Q to give the edge value is met by calculating the different between the pixel and the pixel shift (Figs. 1C and 1D, col. 3, line 5 to col. 4, line 3 of Kuhn).

In considering claim 14, the combination of Hu and Wolf et al disclose all the limitations of the instant invention as discussed in claims 1 and 9 above, except for providing the claimed wherein the integrating further comprises weighting each value by a predetermined weighting factor; and summing the weighted values to give the video quality value. Kuhn teaches that the shifting of the image is performed by interpolation using an appropriate filter such as a linear or sinx/x filter (Fig. 3, col. 4, lines 4-64 of Kuhn). Therefore, it would have been obvious to one ordinary skill in the art at the time of the invention to incorporate the interpolation as taught by Kuhn into the combination of Hu and Wolf et al's system in order to assure that corresponding images to be measured for picture quality are aligned to provide the most accurate determination of picture quality.

In considering claim 15, the claimed wherein the summing is further arranged to sum the weighted values with a predetermined offset value is met by the shifting of the image is performed by interpolation using an appropriate filter such as a linear or sinx/x filter (Fig. 3, col. 4, lines 4-64 of Kuhn).

In considering claim 16, the claimed wherein the weighting factors and the offset value are dependent on the type of the test and reference video fields/frames is met by the shifting of the image is performed by interpolation using an appropriate filter such as a linear or sinx/x filter (Fig. 3, col. 4, lines 4-64 of Kuhn).

Claims 30-35 are rejected for the same reason as discussed in claims 11-16, respectively.

Claims 45-50 are rejected for the same reason as discussed in claims 11-16, respectively.

(10) Response to Argument

Appellant's arguments filed April 12, 2011 have been fully considered but they are not persuasive.

In re pages 13-24, Appellants argue that Hu fails to disclose “matching, by execution of a computer system, sub-field/frame elements of a test video field/frame with corresponding sub-field/frame elements of at least one reference video field/frame, and thereby, generating for the test video field/frame a matched reference field/frame comprising the sub-field/frame elements of the at least one reference video field/frame which match to the sub-field/frame elements of the at least one reference video field/frame which match to the sub-field/frame elements of the test video field/frame;

and positioning, by execution of the computer system, in the matched reference video fields/frame at least one of the matching sub-field/frame elements to compensate for misalignment between at least one of the sub-field/frame elements of the test video field/frame and the at least one matching sub-field/frame elements," as required by independent claim 1 and its dependents and "matching sub-field/frame elements of a test video field/frame, and thereby generating for the test video field/frame a matched reference field/frame comprising the sub-field/frame elements of the at least one reference video field/frame which match to the sub-field/frame elements of the test video field/frame; and shifting, by execution of the computer system, relative to the matched reference field/frame at least one of the matching sub-field/frame elements to compensate for misalignment between at least one of the sub-field/frame elements of the test video field/frame and the at least one matching sub-field/frame elements," as required by independent claim 17 and similarly required by independent claim 20, as well as their respective dependents because the interpretation of "affecting a sub-field/frame element as affecting a sub-field or frame element" would be (A) completely inconsistent with the other explicit words of the claims and context thereof, and (B) completely inconsistent with the explicit teaching of the specification.

In response, it is agreed that the claimed "sub-field/frame elements of a test video field/frame" can be interpreted at "sub-field elements of a test video field and/or sub-frame elements of a test video frame".

As discussed in the advisory action dated 1/26/2011 that Hu discloses the claimed "plurality of sub-frame elements of a test frame".

Hu discloses in from col. 2, line 50 to col. 3, line 20 that

> "In FIG. 2 the reference and test images 24, 26 are shown having some texture 25, i.e., not a matte image. As shown in the test image after processing the texture 25 has been shifted horizontally and/or vertically. An arbitrary test region or block 28 is formed, shown in this example as a rectangle, having a reference and test images. For a rectangle as shown the reference point and horizontal and vertical extents ΔX, ΔY define the test region or block 28. The test region 28 is located where there is substantial texture 25 in the images.
>
> A high precision sub-pixel spatial alignment algorithm is shown in FIG. 3. An initialization module 30 provides the corresponding reference and test images together with a test block to a correlation measurement module 32. The first step 34 in the initialization module 30 controls the video capture module 16 to capture corresponding reference and test images together with a test block to a correlation measurement module 32. The first step 34 in the initialization module 30 controls the video capture module 16 to capture corresponding reference and test images or frames from the reference and test video signals. The second step 36 establishes a test block for overlaying on the respective images in an area that has significant texture 25. The first step 38 of the correlation measurement module 32 applies a fast Fourier transform (FFT) to the **pixels of the images that lie within the test region.** A cross-correlation step 40 is then performed in the FFT domain.
>
> FFT(corr)=FFT(ref)*FFT(tst)
>
> FFT-1(corr) produces **correlation coefficients for every shift point within the test region**, which may be represented in the form of a surface 42 as shown in FIG. 4. The position of a peak 44 in the surface 42 indicates the amount of shift in position between the reference and test images. A curve-fit step 46 provides a nearest integer pixel shift position for the peak 44 based upon the coefficients for the peak position and the positions up, down, left and right from the peak position. The pixel shift position from the correlation measure module 32 is input to an update sift position step 48. For the first iteration only the nearest integer pixel shift position is used."

From the above passages, it is clear that the alleged "plurality of sub-frame elements of a test video frame" is anticipated by the pixels of the images that lie within the test region (or block) or every shift point within the test region (or block).

Additionally, interpreting the alleged "plurality of sub-frame elements of a test video frame" as pixels of the image that lie within the test region or every shift point

within the test region is the broadest reasonable interpretation consistent with the specification.

In re pages 25-28, appellants argue, with respect to the 103 rejection, that dependent claims are allowable for the same reasons as discussed in the independent claims above and that Wolf fails to teach or suggest the act to minimize the effect of sub-field/frame misalignments that are imperceptible to the human viewer and that the statistics processors 22, 24, 30 and 32 do not generate statistical values, but compute a set of source features and destination features as recited in claims 7, 26, and 41.

In response, the examiner respectively disagrees. As discussed above, the independent claims are not limited to only sub-field but include the sub-frame elements and that Hu does disclose the claimed “plurality of sub-frame elements of a test video frame”. Wolf discloses in col. 2, lines 38-41 that "Another object of the invention is to provide a method of measuring video quality that agrees closely with **the perceptual video quality obtained from a large panel of human viewers**” and in col. 6, lines 61-67 that “In one embodiment of the present invention, the source and destination spatial statistics processors 22 and 30 compute the standard deviation of the pixels contained within the **Region Of Interest (ROI)** for which the video quality is to be measured. **The region of Interest may be the entire image, but preferably it is a small subset of the pixels forming the entire image**”. From these passages, it is clear that the sub-frame is used to minimize the effect of sub-frame misalignments that are imperceptible to the human viewer.

As discussed in the Final Office Action dated 10/15/2010 that the statistics processors 22 and 30 of Wolf et al described from col. 6, line 3 to col. 8, line 38 generate the claimed video quality parameter dependence from the calculating one or more matching statistic value and/or matching vectors as recited in claims 7, 26 and 41.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

June 13, 2011

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